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(54) Title: **PERSONAL SERVER TECHNOLOGY**

(57) Abstract: The present invention is a connectivity solution that integrates the electric and electronic-based objects in a home, office or other space into an integrated control, and monitoring, and computing network. The present invention comprises a server-like apparatus that mediates the control, monitoring, and computational functions. A user enters commands and receives information from a remote device that communicates with the server-like apparatus. The remote device functions both within the networked space (e.g., in and around the home or office), and from outside of it (via modem connection, the Internet, or some other type of external access). VCRs, TVs, home entertainment systems, kitchen appliances, light fixtures, pools, alarms systems, environmental controls, cameras, microphones, computers and weather stations are just some of the objects that can be controlled and monitored by the user from a Remote Device. The remote device presents the user with a powerful, easy-to-use interface environment that intuitively maps to the objects on the network. The present invention thus brings the user remote connectivity to things that are most important to the user and implements an automated, intelligent, seamlessly connected "home or office of the future".

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PERSONAL SERVER TECHNOLOGY

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is a connectivity solution for use in the home, office and other locations. It comprises a server-like apparatus that integrates home appliances, entertainment systems, computing devices, and other objects into a coordinated wireless control and monitoring network. A remote device is used to control and monitor these objects via the functioning of the server-like apparatus. The server-like apparatus is also connected to other networks, such as the Internet. The remote device presents the user with a powerful, easy-to-use interface environment that intuitively maps to the objects on the network and the actions and activities being performed. The present invention thus implements an automated, intelligent, seamlessly connected "home or office of the future."

2. Description of Related Art

The prior art includes numerous systems that monitor and control electronic appliances and other objects in the home and office. Such systems are limited almost exclusively to "remote control" – the use of a hand-held device to send instructions directly to and receive information directly from one, or at most a few, objects. One example of such a remote control device is the standard VCR remote, which operates on infrared light wavelengths ("IR"). A VCR remote is typically used to program recording parameters into a VCR and to operate the VCR in real-time. Similar remotes exist for TVs, CD players and other appliances. Lights and other household fixtures can also be controlled by remote, usually by installation of a component that allows for simple commands such as on/off and dimming in response to hardwired timers, audible input, or other control means.

However, the state of remote control in the current art is nascent. Some objects such as VCRs and CD players usually have remote control devices, but many do not. Even among the objects that do have remote control, such objects are not controlled through integrated networks. In fact, the notion of a connectivity system or solution hardly applies to the state of the current art. Of the relatively few objects in a present-day home or office that can be controlled by remote, each one generally requires a separate remote control device. Sometimes, a handful of objects can be controlled with a single remote (e.g., CD player, amplifier and tuner all from a single manufacturer that are standardized

to a single remote, or the "universal" remote² that can control a large number of TVs and VCRs).

The current art does include home control systems that allow a user to control lights, sound systems, and other fixtures throughout the household. While appearing to be more of a true "control network," these systems still exhibit only rudimentary control over and feedback from objects that are connected to the network. In addition, these systems are difficult to implement, and do not offer the power and flexibility of a programmable, software-based network. They also cannot be controlled and monitored from outside the home via network and Internet connections.

The true networks that do exist in the current art are essentially limited to information exchange. For instance, U.S. Patent 5,809,415, issued to Rossmann, which is herein incorporated by reference in its entirety, describes a two-way, portable data-communication device that allows a user access to a wide-area network such as the Internet. Such inventions are limited in the opposite way that home-control and remote-control systems are limited. The former cannot manipulate and monitor the physical world, at least not to any appreciable degree, while the latter lack the information, control and integration aspects of a true network.

For these reasons, among others, there is a need in the art for a true network that can bring a large number of objects under the control of a single, integrated connectivity solution. This solution would ideally be flexible enough to be programmed for different network configurations and settings with ease, and be powerful enough to allow the user to have precise control and perception of the objects in the network through the metaphor of an intuitive user interface.

SUMMARY OF THE INVENTION

The present invention offers an integrated connectivity solution for remote control of various network integrated household and office objects ("Controlled Devices"). It comprises a software-based network that can perform information-heavy tasks and that incorporates sophisticated object monitoring and control, as well as computational activities, into the network. The present invention consists of a server-like apparatus ("Personal Server") that controls a network, and performs computational tasks, in the home, office, or other location. The Personal Server is accessed through a Remote Device, generally a hand-held, personal digital assistant ("PDA"), a data-enabled telephone or cellular phone ("SmartPhone"), or some form of internet access device. PALM O/S™ devices such as the PALM PILOT™, PALM III™ and PALM IV™, and WINDOWS CE™ devices such as the PHILIPS NINO™, CASIO CASSIOPEIA™ and HP JORDANA™ are common PDAs that are readily adaptable for use with the present invention. The Qualcomm PdQ phone, a cellular phone with digital computing and display capabilities, is an example of a SmartPhone that will work well with the present invention.

The present invention allows users to control and monitor various Controlled Devices. These functions can be accomplished from within the location where the Personal Server is located, or from the outside world through a dial-up connection, network, or the Internet, or other means. Remote information tasks, such as file exchange, computational activity and financial transactions can also be carried out by the Personal Server, using a Remote Client operating on a Remote Device as the interface. Third parties, such as alarm companies and police departments, can be given full or partial access to the monitoring and control functions of the Personal Server.

BRIEF DESCRIPTION OF THE DRAWINGS

The purpose and advantages of the present invention will be apparent to those skilled in the art from the following detailed description in conjunction with the appended drawings, which show typical embodiments of the invention.

FIGURE 1 illustrates a preferred embodiment of the Personal Server, including Action Modules 1, Scheduler/Router 2 and Input/Output Modules 3. Examples of Input/Output Modules, including typical connection objects/protocols, are included.

FIGURE 2 illustrates some examples of the physical connection and data transfer protocols that can be used between the Remote Device and the Personal Server.

FIGURE 3 shows a control panel that is used to configure the network of objects on the Personal Server, in this case, those objects that are on an ACTIVEHOME™ X10 system.

FIGURE 4 shows an example of a screen on the Remote Client interface running on the Remote Device used with the present invention, in this case, Home Pad. Home Pad is used to control Controlled Devices such as home appliances and fixtures.

FIGURE 5 shows an embodiment of Home Pad on a more graphically limited Remote Device, namely, a cell phone.

FIGURE 6 shows a second example of a screen on the Remote Client interface running on the Remote Device used with the present invention, in this case, Credit Pad. Credit Pad is used to verify and charge credit card numbers.

FIGURE 7 shows a third example of a screen on the Remote Client interface running on the Remote Device used with the present invention, in this case, File Retriever. File Retriever is used to retrieve files from the Personal Server.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to preferred embodiments of the invention, so as to enable a person skilled in the art to make and use the invention in the context of a

particular application. It is understood that such embodiments are not intended to limit the invention to one preferred embodiment or application. On the contrary, the invention is intended to cover alternatives, modifications, and equivalents. Various modifications to the present invention will be readily apparent to one of ordinary skill in the art, and can be made to the described embodiment within the spirit and scope of the invention as defined by the appended claims.

In a preferred embodiment, the core of the present invention is a server-like apparatus ("Personal Server"). The Personal Server, in a preferred embodiment, comprises software run on a general-purpose computer. The computer can be a server, workstation, dedicated hardware device, or any other type of computer, but in the described embodiment, the computer is a desktop PC. In other embodiments, the Personal Server comprises hardware specifically designed for the invention, or a combination of hardware and computer software. The software can be a component bought off the shelf, a component specially designed for a particular home or office, a plug-in to a software developer's kit, or part of a larger proprietary system, among other embodiments. The software of the Personal Server is typically written in C, C++ or Java. The Personal Server is designed to have a robust and flexible interface that makes it easy for developers to develop Input/Output and Action Modules that operate with the present invention.

1. Software Architecture

a. Personal Server

The following is a preferred embodiment of the software architecture of the present invention. FIGURE 1 illustrates a further preferred embodiment, in detail:

The Personal Server has a software architecture that consists of the following components: (1) Input/Output Modules, (2) a core Scheduler/Router with data logging capabilities and (3) Action Modules. The Input/Output Modules and Action Modules are self-contained code libraries designed to be detected by the Scheduler/Router and connected at run-time. This architecture allows developers and consultants to develop additional modules, either for a class of users or Controlled Devices or on a case-by-case basis for specific individual users, to fit those users needs. In particular, as new forms of communication, types of Controlled Devices, and activity are developed through technological development and commercial innovation, new types of modules will be developed. Such modules can be added to the Personal Server by direct installation or by downloading on an ad-hoc basis from remote sources. They can also be dynamically added to individual installations of the Personal Server, with or without user intervention, to minimize service interruption.

Input/Output Modules serve to connect a user's Remote Device to the Personal Server, but they can be designed for other modes of communication as well. Various types of physical connections and data-transfer protocols can be used, as illustrated in FIGURE 2. At synchronization, the Remote Device sends the information entered by the user to an Input/Output Module or Input/Output Modules. This information is translated into a

5 "Message" by the Input/Output Module. Messages generally contain information on the user, the Remote Device, the target Action Module and data specifics. The Message may be encoded or encrypted for the purpose of data security. In one encryption scheme, Messages are encrypted by the Remote Device prior to transmission, and then decoded
10 by the Input/Output Module. The Input/Output Module then passes the Message to the Scheduler/Router, which logs it into a database, processes it as necessary, and passes the Message again to the appropriate Action Module. The Action Module then performs the requested actions. After the action has been completed, the Action Module creates a second Message containing user-requested information, results of calculations or
15 computations, information on whether the action has been successfully completed, date and time stamps, and whether additional instructions are needed. The Action Module passes the Message to the Scheduler/Router, which logs it, processes it as necessary, and passes it, if necessary, to the Input/Output Module that communicates its contents, possibly in encrypted format, to the Remote Device. Additional messages not specifically
20 mentioned may be created and sent as particularly in other embodiments. Alternate embodiments employ separate Input Modules and Output Modules rather than combined Input/Output Modules. In such alternate embodiments, Input Modules are responsible for receiving Messages from the Remote Device, whereas Output Modules are responsible for sending Messages to the Remote Device.

25 At start-up, the Scheduler/Router loads the existing Input/Output Modules and Action Modules and monitors them for activity. As noted, the Scheduler/Router processes and relays Messages between the Input/Output and Action Modules. It maintains information on user identification, user password and security information, as well as logs of the Messages. In a preferred embodiment, a Utility Module is written as an adjunct to the Scheduler/Router, which allows the user to enter settings. The Utility Module will generally have a control-panel type interface to aid in configuring new user preferences and new modules.

30 The Action Modules or the Scheduler/Router may initiate messages to the user. If the user has requested an action to be performed that may take a long time, the user may disconnect and request that the results be sent back at a later time. Alternately, a Controlled Device may initiate a communication, triggering an Action Module to send a Message to the Scheduler/Router. In this way, the user may configure the system so that
35 the Personal Server initiates communication when triggered by an event such as a home alarm being set off. Results may be sent back when the user connects again, by a connection established by the Personal Server, or by another communication means such as pager, telephone, fax, or e-mail.

40 **b. Input/Output Modules**

As described in the section above, Input/Output Modules serve as connection points between the Personal Server and the Remote Device. The various Input/Output Modules in place with a particular embodiment of the Personal Server are designed to handle various connectivity and data-transfer protocols (some examples of which are listed in
45 FIGURE 2). In a preferred embodiment, proprietary PDAs protocols such as

HOTSYNC™ (for PALM OS™ devices) and⁶ACTIVESYNC™ (for WINDOWS CE™ devices) are among these protocols. In the case of incoming Messages an Input/Output Module communicates with a Remote Device by synchronizing with the Remote Device, receiving and interpreting a Message from the Remote Device, optionally decrypting the Message if it is in encrypted form, and then passing the Messages on to the Scheduler/Router which in turn optionally passes that Message in original or modified form on to an Action Module and possibly a Controlled Device. In the case of outgoing Messages an Input/Output Module communicates with a Remote Device by synchronizing with the Remote Device, receiving and interpreting a Message from the Scheduler/Router (which Message may have originated from a Controlled Device or Action Module), optionally encrypting the Message, and then passing the Messages on to the Remote Device, which in turn decrypts the Message as necessary.

In alternate embodiments connection to the Input/Output Modules may be mediated by an Internet service designed specifically to communicate with the Personal Server, or else to a general-purpose Internet service (the "Service"). The user operating the Remote Device may log in or otherwise connect to the Service. In either event, the user accesses a network server (the "Internet Server") which runs the Service via a website or other user interface. Once the user has logged in using a Remote Device, the Service will then complete the final link to the Personal Server. The Service may dial-in, or use any of the means of connectivity supported by the Input/Output Modules, and then communicate with the Personal Server using standard protocols. The Messages from the Personal Server are then communicated back to the user. Thus a user can use a Remote Device such as a Web-enabled cellular phone to connect to a Personal Server at home or at the workplace.

In alternate embodiments there may be no encryption provided, or the encryption/decryption function may occur at different locations on the system such as at the Scheduler/Router, Action Module, or Controlled Device rather than or in addition to the encryption provided by the Input/Output Module. In other alternate embodiments encryption/decryption functions may occur at the level of the Remote Client or the Service rather than or in addition to the encryption provided by the Remote Device.

c. Action Modules

The Action Modules are the software objects that actually carry out instructions specified by the user, and that obtain status and other information from and send instructions to the Controlled Devices. Because of the wide variety of specific actions they carry out, Action Modules will often include their own databases to assist in their functions. Some Action Modules will have their own connectivity to the Web and to other communication lines. An Action Module may be connected to a third party or parties, to the Internet, to other computer systems, or to other networks (even other Personal Server networks).

d. Messages

In a preferred embodiment Input/Output Module some Messages from the Input/Output Module to the Scheduler/Router comprise user information, intended Action Module or modules, message length, time stamp and data specifics. The data specifics contain specific commands to the Action Module or Action Modules such as requests for state information as well as any data needed by the Action Module to perform its tasks

Messages from the Scheduler/Router to the Input/Output Module comprise user information, Action Module identification, message length, time stamp, and data specifics. The data specifics contain responses requested by the user, the results of actions performed, state information, response formatting information, and possible requests for additional information from the input device.

In alternate embodiments Messages may originate or terminate, or be interpreted, parsed, decoded, encoded, modified, scheduled, or otherwise processed by the Remote Client, the Remote Device, the Service, the Input/Output Module, the Scheduler/Router, the Action Module, or the Controlled Device. New Input/Output Modules and message protocols can be developed by one of ordinary skill in the art as new technologies, in particular O/S device types, are developed.

e. Remote Client/Remote Device

The Remote Client is the user's interface and architecture for the Personal Server. It resides on the Remote Device as a data-gathering/presentation medium. The Remote Device, in a preferred embodiment, is a handheld PDA such as a PALM O/STM WINDOWS CETM device, or SmartPhone. In alternate embodiments the Remote Device may be a desktop personal computer or any form of Internet access device. Since many Remote Devices, especially handheld devices, are limited in terms of processing power, memory and display capabilities, the Remote Client is generally designed with these limitations in mind. Therefore, in a preferred embodiment, the software architecture of the present invention relies most heavily on the Personal Server itself, rather than on the Remote Client. In some embodiments, a laptop or even desktop computer will act as the Remote Device, often connected through a network, such as the Internet, but even in these cases, the degree of input available from the computer may be limited. In addition, a web page served by a mediating Service on the Internet may serve as the interface for communication to the user. This allows limited input through an Internet access device such as a SmartPhone or Internet kiosk.

The Remote Client presents an environment that precisely maps to the network of objects to be controlled through the Personal Server, thus allowing seamless control and perception over the network. The Remote Client has the appropriate interfaces, which communicate with the Input/Output Modules of the Personal Server. The Remote Client is generally designed with the most minimal interface environment that nonetheless remains clear and intuitive to the user. FIGURES 4-6 illustrate sample Remote Client environments, including Home Pad, Credit Pad and File Retriever (see "Brief Description of Drawings"). While somewhat less complex than an environment on the Personal Server itself, such as the X10 control interface of FIGURE 3, Remote Client

environments nonetheless remain robust and easy to use.

The Remote Client also generally uses the minimum amount of encryption and authentication necessary to preserve security. Remote Devices, particularly third-party Remote Devices, will generally be programmed to operate as the Remote Client. Some Remote Devices will be adapted with additional hardware to operate as the Remote Client, and some will be manufactured specifically for use with the present invention.

Remote Devices may use a variety of physical connection and data transfer protocols to communicate with the Personal Server, some examples of which are illustrated in FIGURE 2. Typically more than one protocol will be available, depending on where the user and the Remote Device happen to be at the time of linking. The following is another way of categorizing the types of connections:

1. Through the same wireless network that is used to control objects in the home or office (used when the user is in or near that home or office).
2. Through a different wireless network
3. Through a direct wire-based or wireless connection, such as a serial computer interface (used when the Remote Device is "plugged-into" the Personal Server for data transfer or programming).
4. Through a dial-in modem connection.
5. Through a dial-up service, Internet service, or other mediating Service on the Internet or other Wide-Area networks

Traditional phone lines, leased lines and satellite connections are among the communication pipes that can be used to support these physical connections. In some cases, it will be desirable for the user to authorize third-party access to some or all of the control and monitoring systems of the Personal Server. For instance, a user may allow an alarm company to monitor the alarm system. The user may also wish to give some access to a family member or friend if the user is on vacation or otherwise indisposed.

2. Method

a. Direct connection.

The following flowchart illustrates, as a preferred embodiment, the method of using a device constructed in accordance with the present invention to carry out a typical task, such as programming a VCR.

1. The user enters information concerning the desired action into the Remote Device via the Remote Client
2. The Remote Device stores the information
3. The user synchronizes the Remote Device by indicating to the Remote Client that the information should be transmitted
4. The Remote Device dials into the Personal Server via cellular modem

Either of the above flowchart embodiments may be applied, with modifications, to the control and monitoring of objects other than the VCR, and to other system embodiments described herein.

5 2. Functionality

The Personal Server is designed to carry out three functions, among others: control, monitoring and remote information tasks. Other functions are obvious to one of ordinary skill in the art. The Personal Server is typically used to control and monitor the following
10 types of Controlled Devices: remote-ready objects, non-remote-ready objects and other objects. Many Controlled Devices will have both control and monitoring aspects to them, (e.g. "is the porch light on?" "turn on the porch light"), though some will have relatively more of one type of functionality than the other. As an example, VCR's have relatively more control functions, relating to programming the VCR, than monitoring/status
15 functions.

Typically, within the home or office, the Personal Server and its Controlled Devices will operate on a wide area network ("WAN") or local area network ("LAN"). In a preferred embodiment, Intel's BLUETOOTH™ is the hardware standard and protocol used to put
20 together the network. Many other hardware and protocol implementation are obvious to one of ordinary skill in the art. In general, communication nodes will be used to broadcast the network signals to Controlled Devices on the network. For example, in one embodiment, X10 stations are used with the present invention to broadcast the signals.

25 a. Remote-ready objects

Remote ready Controlled Devices are appliances that are already remote-capable. These objects typically include VCRs, TVs, CD players, home or office security systems, and other sophisticated electronic devices that normally come with remote capability
30 (generally using infra-red signals, in the current art). In addition, there are many standard household controls such as light switches, thermostats, garage doors, and alarm systems that are designed specifically for home-automation purposes. The Personal Server takes advantage of such remote capability to communicate with these devices. Many Controlled Devices use standardized communication protocols, which makes it a straightforward matter to communicate with these devices ("universal" remotes, for
35 instance, take advantage of these standards). The Personal Server can be programmed with additional Input/Output Modules to allow for communication with non-standard objects, however. Input/Output Modules may be developed by value-added providers to enable the Personal Server to communicate with new and non-standard devices as they are developed.

40 As a further illustration, consider the activity of programming a VCR, discussed in the above section on overall architecture. The user, could, of course, program the VCR directly via the VCR console or remote. The present invention makes it a simple matter to program the VCR from the computer that runs the Personal Server. The user will
45 typically enter the time and channel to record, or else a code corresponding to a program

5. The Personal Server's Input/Output Module receives the phone call
6. The Input/Output Module uploads the information from the Remote Device, creates a Message, and alerts the Scheduler/Router
7. The Scheduler/Router determines that the Message is intended for the VCR Action Module
8. The Scheduler/Router passes the message to the VCR Action Module, which parses the Message and in turn sends appropriate instructions to the VCR
9. The VCR Action Module sends a new Message to the Scheduler/Router, confirming that the action was or was not taken, among other status details
10. The Scheduler/Router logs, processes and passes the new Message to the appropriate Input/Output Module
11. The Input/Output Module responds to the Remote Device, if necessary, reestablishing the connection if need be
12. The Remote Device displays relevant status information to the user via the Remote Client
13. The Input/Output Module hangs up the modem connection as necessary

a. Network-mediated connection.

The following flowchart illustrates, as an alternate embodiment, the method of using a device constructed in accordance with the present invention to carry out a typical task using the Internet as an intermediary communications mechanism. The user accesses and logs onto the Service using the Remote Client running on the Remote Device.

2. The Service presents the Remote Client with a Web page designed as an interface for programming a VCR
3. The user enters the appropriate information and indicates that the data is complete
4. The Service dials into the Personal Server via dial-up or other connectivity
5. The Personal Server Input/Output Module receives the call
6. The Input/Output Module uploads the information from the Service, creates a Message, and alerts the Scheduler/Router
7. The Scheduler/Router determines that the Message is intended for the VCR Action Module
8. The Scheduler/Router passes the message to the VCR Action Module, which in turn parses the message and sends appropriate instructions to the VCR
9. The VCR Action Module sends a new Message to the Scheduler/Router, confirming that the action was or was not taken, among other status details
10. The Scheduler/Router logs, processes and passes the new Message to the appropriate Input/Output Module
11. The Input/Output Module responds to the Service, if necessary, reestablishing the connection if need be.
12. The Service creates a Web page displaying relevant status information to the user via the Remote Client
13. The Input/Output Module closes the connection to the Service.

(such as a VCR-PLUSTM code). In a preferred embodiment, the user is also able to enter the name of the program, and the Personal Server, by interacting with a database or data source (such as a database available on the Internet), determines the program specifics. The Personal Server is sophisticated enough in its architecture to prompt the user if there is problem with the information entered, or if it cannot complete the task (for instance, if the VCR is already programmed for another program at the same time). It will also prompt the user with other status information, when it is appropriate.

Of course, the user generally will wish to program the VCR from a Remote Device rather than from the Personal Server itself. The present invention, by connecting the Remote Device to the Personal Server in a seamless fashion, makes this effectively the same task.

b. Non-remote-ready-objects

Non-remote-ready Controlled Devices are those objects that typically are not remote capable. Examples of these objects include microwave ovens, dishwashers, toasters and coffee makers. Increasingly, such devices are being manufactured remote-ready. As Personal Servers become increasingly common, this trend will likely continue. For objects that are not remote-ready, a user will be able to adapt the objects for remote use with additional hardware. At the very least, such objects can be controlled with simple commands by installing remote switches such as X10TM units (see "Other objects," below), or, failing that, at least simple on/off switches.

The programming of a non-remote-ready device is similar in implementation to the programming of a VCR outlined above. One difference though is that non-remote-ready objects tend to be more dependent on status in order to function in an appropriate manner. For instance, there should be coffee in the coffee maker or food in the microwave oven before the Personal Server activates these objects. It is partially for this reason that such objects have not been as readily adapted for remote use as some others have. Leaving a tape in a VCR and then wishing to program it later is a common desire. Leaving dirty clothes in a washing machine and washing them later is not so common. Nonetheless, the ability to do so must be convenient in some cases, such as turning a coffee machine on in the morning. As Personal Servers become more common, users will wish to take advantage of these conveniences, and thus more objects not envisioned as readily adaptable to remote use will be made remote-ready.

c. Other objects

There are a number of other objects that can be controlled and monitored with the Personal Server. For example, simple objects such as lighting fixtures can be equipped with X-10TM control units, which can be used to turn them on and off and to dim them. Much more sophisticated objects, such as pools and Jacuzzis, environmental systems, weather stations and television cameras, among others, can be controlled and monitored with the present invention. Again, the user may well need to adapt these objects for use with the Personal Server by installing hardware attachments.

One form of Controlled Device that merits special attention is a home or office computer. Either the Personal Server itself, or a separate computer, may function as a Controlled Device when operated in connection with the present invention, operated remotely via the Remote Client to perform a variety of tasks such as sending or retrieving electronic mail, voice mail, or faxes, uploading and downloading files, and connecting to the Internet.

The types of Controlled Devices that can be incorporated into the Personal Server system are almost limitless. As one example, the system can be used to detect how many cars are sitting in the garage or driveway through the use of cameras, external sensors or chips embedded in cars. The latter is a particular cheap and simple way of bringing automobiles into the domain of the Personal Server. More sophisticated control features, such as remote car warmers, security systems or ignition devices, will become amenable to the present invention as available technology improves, and as users, vendors and inventors become more accustomed to and imaginative about such uses. One of ordinary skill in the art can imagine boundless examples. In this way, the present invention provides a broad basis for future technical development.

d. Remote Information Tasks

One of ordinary skill in the art will appreciate that remote information uses will also proliferate as technology, commercial innovation and commercial imagination develop. One current use is the transfer of computer files, such as video, spreadsheets, word processing documents and figures between the Remote Client and the Personal Server. These files may be used as part of the various control and monitoring features of the Personal Server, for example, remote viewing of images or streaming video from household cameras, or they may be entirely unrelated.

Communication can be done continuously, or in bursts, depending on need. Either the Remote Client of the Personal Server, and in some embodiments, objects in the network, can initiate and terminate communications. If there is a calculation or process that takes a great deal of time, the user may initiate the process remotely, terminate communication, and then check in from time to time to see if the process or calculation has been completed.

In one embodiment, the Personal Server can act as a pass-through communications link for the Remote Client. For instance, the user can surf the Internet remotely from the Remote Device via the Personal Server. Computational tasks and file retrieval can be done in a similar manner. The user can accomplish these tasks in real-time or else send the task to the Personal Server and then end the transmission. At some later time, when the Personal Server has completed the task or requires additional information, the Personal Server may request that communication be reestablished.

One particularly convenient use for the present invention applies to credit-card transactions. Merchants using the current invention can verify credit-card numbers by uploading them from the Remote Device (which will generally have a card reader) to the Personal Server for verification. A credit-card charge can be carried out in a similar

manner. Other, transactions, financial and otherwise, are obvious to one of ordinary skill in the art.

Though the foregoing invention has been described in detail for purposes of clarity of understanding, it will be apparent that various changes and modifications may be practiced within the scope of the appended claims. It is therefore intended that the following appended claims be interpreted as including all such alterations, permutations, and equivalents as fall within the spirit and scope of the present invention. All publications and patents herein are incorporated by reference in their entirety.

REFERENCES

U.S. Patent 5,809,415, "Method and Architecture for an Interactive Two-Way Data Communication Network," issued to Rossmann.

CLAIMS

What is claimed is:

- 1 A system for remote control and monitoring of objects, the system comprising:
 - (a) A personal server, which comprises a server-like apparatus that performs actions chosen from a list that includes:
 - i. receiving user commands, processing those commands, and outputting those commands to objects that are networked to the personal server; and
 - ii. receiving status information from objects that are networked to the personal server; and
 - (b) An integrated network for communication between the personal server and the objects, wherein said personal server performs one or more actions chosen from the list comprising control and monitoring.
- 2 The system described in claim 1 further comprising a means of remote connectivity from the user to the personal server.
- 3 The system described in claim 1 wherein said personal server logs said commands.
- 4 The system described in claim 1 wherein said personal server comprises software run on a general-purpose computer.
- 5 The system described in claim 4 wherein said software comprises action modules, and a scheduler/router.
- 6 The system described in claim 5 wherein said action modules communicate with said objects.
- 7 The system described in claim 6 wherein at least some of said action modules are specially-designed to interface with devices having non-standard remote protocols.
- 8 The system described in claim 6 wherein at least some of said action modules are general-purpose interfaces which communicate with devices with standard remote control protocols.
- 9 The system described in claim 5 wherein said software further comprises I/O modules chosen from a list that includes input modules, output modules, and combined input/output modules.

- 10 The system described in claim 1 wherein said I/O modules communicate with a remote client.
- 11 The system described in claim 1 wherein at least some of said objects on said network are controlled and monitored via means chosen from a list that includes infrared communication, X10 protocol, TCP/IP protocol, or Bluetooth protocol.
- 12 The system described in claim 1 wherein at least some of said objects on said network are controlled and monitored via a wireless protocol.
- 13 The system described in claim 1 wherein broadcasting stations are used to broadcast network signals to said objects.
- 14 The system described claim 13 wherein said broadcasting stations are HOUSELINC stations.
- 15 The system described in claim 1 wherein at least some of said objects are remote ready.
- 16 The system described in claim 1 wherein at least some of said objects are specially adapted for use with said system.
- 17 The system described in claim 1 wherein at least some of said objects are not remote-ready objects and have been enabled to communicate with said personal server using special control attachments.
- 18 The system described in claim 17 wherein said attachments use X10 technology.
- 19 The system described in claim 17 wherein said attachments use LonTalk technology.
- 20 The system described in claim 1 wherein at least some of said objects are chosen from the list that comprising VCRs, TVs, home entertainment systems, kitchen appliances, light fixtures, pools, Jacuzzis, alarms systems, environmental controls, cameras, microphones, personal computers, security systems, and weather stations.
- 21 The system described in claim 1 wherein said system is used in a home or office.
- 22 The system described in claim 1 wherein said personal server is written using C, C++ or Java.
- 23 The system described in claim 1 wherein said personal server is an off-the-shelf component or a component of a hardware system.
- 24 The system described in claim 1 wherein said personal server is part of a third-party proprietary system or a custom-developed system.

- 25 The system described in claim 1 wherein said network is a wireless network.
- 26 The system described in claim 25 wherein said wireless network is a LAN, WAN or VPN.
- 27 The system described in claim 25 wherein said network hardware is on a BLUETOOTH standard.
- 28 The system described in claim 25 wherein the network protocol is JINI.
- 29 The system described in claim 1 further comprising a remote device from which a user enters said commands.
- 30 The system described in claim 29 wherein said remote device is a PDA.
- 31 The system described in claim 29 wherein said remote device is a SmartPhone.
- 32 The system described in claim 29 wherein said PDA is a PALM OS or WINDOWS CE device.
- 33 The system described in claim 29 wherein the remote device runs remote client software.
- 34 The system described in claim 33 wherein the remote client software is specially programmed for use with said system.
- 35 The system described in claim 33 wherein the remote client software is an application running on a computer including the computer on which the personal server is running.
- 36 The system described in claim 29 wherein said remote device is a general-purpose computer.
- 37 The system described in claim 29 wherein said remote device is an Internet access device.
- 38 The system described in claim 29 wherein said remote device is used to scan credit cards for processing by said personal server.
- 39 The system described in claim 29 wherein said remote device is hardware-adapted for use with said system.
- 40 The system described in claim 29 wherein said remote device is specifically manufactured for use with said system.

- 41 The system described in claim 29 wherein said remote client communicates with said personal server via a cellular modem connection.
- 42 The system described in claim 29 wherein said remote client communicates with said personal server via a serial connection.
- 43 The system described in claim 29 wherein said remote client communicates with said personal server via a leased-line or satellite connection.
- 44 The system described in claim 29 wherein said remote client communicates with said personal server via a LAN, WAN or VPN.
- 45 The system described in claim 29 wherein said remote client communicates with said personal server via the Internet.
- 46 The system described in claim 29 wherein said remote client communicates with said personal server via a service on the Internet.

AMENDED CLAIMS

[received by the International Bureau on 09 July 2001 (09.07.01);
original claims 1, 12 and 29 amended ; remaining claims unchanged (3 pages)]

1. A system for remote control and monitoring of objects, the system comprising:

5

(a) a personal server, which comprises a server-like apparatus that performs actions chosen from a list that includes:

- i. receiving user commands; processing those commands, and outputting those command to objects that are networked to the personal server; and
- 10 ii. receiving status information from objects that are networked to the personal server; and

(b) an integrated network for communication between the personal server and the objects, wherein said personal server performs one or more actions chosen from the list comprising control and monitoring.

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(c) a remote device which communicates with the personal server and includes: a microprocessor, a memory, and an integrated visual display for displaying graphical user interfaces.

20

2. The system described in claim 1 further comprising a means of remote connectivity from the user to the personal server.

3. The system described in claim 1 wherein said personal server logs said commands.

25

4. The system described in claim 1 wherein said personal server comprises software run on a general-purpose computer.

5. The system described in claim 4 wherein said software comprises action modules, and a scheduler/router.

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6. The system described in claim 5 wherein said action modules communicate with said objects.

7. The system described in claim 6 wherein at least some of said action modules are specially-designed to interface with devices having non-standard remote protocols.

8. The system described in claim 6 wherein at least some of said action modules are general purpose interfaces which communicate with devices with standard remote control protocols.

9. The system described in claim 5 wherein said software further comprises I/O modules chosen from a list that includes input modules, output modules, and combined input/output modules.

10. The system described in claim 1 wherein said I/O modules communicate with a remote client.

11. The system described in claim 1 wherein at least some of said objects on said network are controlled and monitored via means chosen from a list that includes infrared communication, X10 protocol, TCP/IP protocol, or Bluetooth protocol.

12. The system described in claim 1 wherein at least some of said objects on said network are controlled and monitored via a wireless protocol.

13. The system described in claim 1 wherein broadcasting stations are used to broadcast network signals to said objects.

14. The system described claim 13 wherein said broadcasting stations are HOUSELINC stations.

24. The system described in claim 1 wherein said personal server is part of a third-party proprietary system or a custom-developed system.

25. The system described in claim 1 wherein said network is a wireless network.

26. The system described in claim 25 wherein said wireless network is a LAN, WAN or VPN.

27. The system described in claim 25 wherein said network hardware is on a BLUETOOTH standard.

28. The system described in claim 25 wherein the network protocol is JINI.

29. The system described in claim 1 wherein the remote device communicates with the personal server via a direct electrical connection, a modem, a network, light wave data transmission, or radio frequency data transmission.

30. The system described in claim 29 wherein said remote device is a PDA.

31. The system described in claim 29 wherein said remote device is a SmartPhone.

32. The system described in claim 29 wherein said PDA is a PALM OS or WINDOWS CE device.

33. The system described in claim 29 wherein the remote device runs remote client software.

34. The system described in claim 33 wherein the remote client software is specially programmed for use with the system.

Statement

Claim 1 was amended to correct format errors and add the limitation of "a remote device which communicates with the personal server and includes: a microprocessor, a memory, and an integrated visual display which can display a plurality of graphical user interfaces." The term "A personal server" was amended to "a personal server" and the term "An integrated network" was amended to "an integrated network."

Claim 12 was amended to correct a typographical error. The term "networke" is now "network."

Claim 20 was amended to correct a typographical error. The term "alarms systems" is now "alarm systems."

Claim 29 depends from claim 1 and was amended to remove the limitation that the system further comprises a remote device from which a user enters said commands. The remote device limitation is part of the amended claim 1. Claim 29 was also amended to add the limitation that the remote device communicates with the personal server via a direct electrical connection, a modem, a network, light wave data transmission, or radio frequency data transmission.

The amendment adding the remote device having a microprocessor, memory and integrated display is supported by the application specification. "The Remote Device, in a preferred embodiment, is a handheld PDA such as a PALM O/S™ Windows CE™, or

SmartPhone. In alternative embodiments the Remote Device may be a desktop personal computer or any form of Internet access device. Since many Remote Devices, especially handheld devices, are limited in terms of processing power, memory and display capabilities, the Remote Client is generally designed with these limitations in mind.” (Application, page 8, lines 21-28.) Although the remote device has processing, memory and display limitations, it is still capable of running software, storing data and processing information.

The references cited in the PCT International Search Report do not include a remote device having a microprocessor, memory and an integrated visual display for displaying graphical user interfaces.

1. Humpleman et al., U.S. Patent No. 6,198,479

U.S. Patent No. 6,198,479 (Humpleman et al.) was cited in the International Search Report as being of particular relevance. The Humpleman reference discloses a control system which uses a personal computer to operate devices connected to a network. The applicant respectfully submits that Humpleman does not disclose the remote device having a microprocessor, programmable memory and a visual display which communicates with the personal server. Humpleman discloses a “control device” which is a computer having a monitor and a mouse and controls “home devices.” “By way of definition, it is contemplated that a ‘client’ is a device providing control interface service to a human operator, including a graphical display hardware for down communication and a mouse or other point-and-click device for up (or return) communication.” (Humpleman, Col. 5, lines 30-34.) “Thus, in certain embodiments of the inventions, a device such as a

personal computer ("PC") is used to provide the human interface for a respective home network, as a PC typically embodies a screen display unit." (Humbleman, Col. 6, lines 5-9.) The applicant did not find a description of a control device other than a personal computer in the Humbleman reference.

2. Ogino et al., U.S. Patent No. 6,038,625

U.S. Patent No. 6,038,625, (Ogino et al.) was also cited in the International Search Report as being a reference of particular relevance. The Ogino reference discloses a set top box which is used to control networked components. "Although a variety of different computer systems can be used with the present invention, an exemplary general purpose computer system is shown in the set-top-box FAV of FIG. 2." (Ogino, Col. 8, lines 11-14.) The Ogino reference does not disclose the user interface with the set top box and does not disclose a remote device having a microprocessor and visual display.

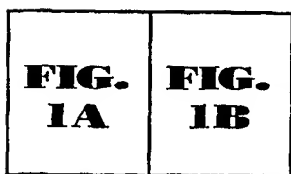
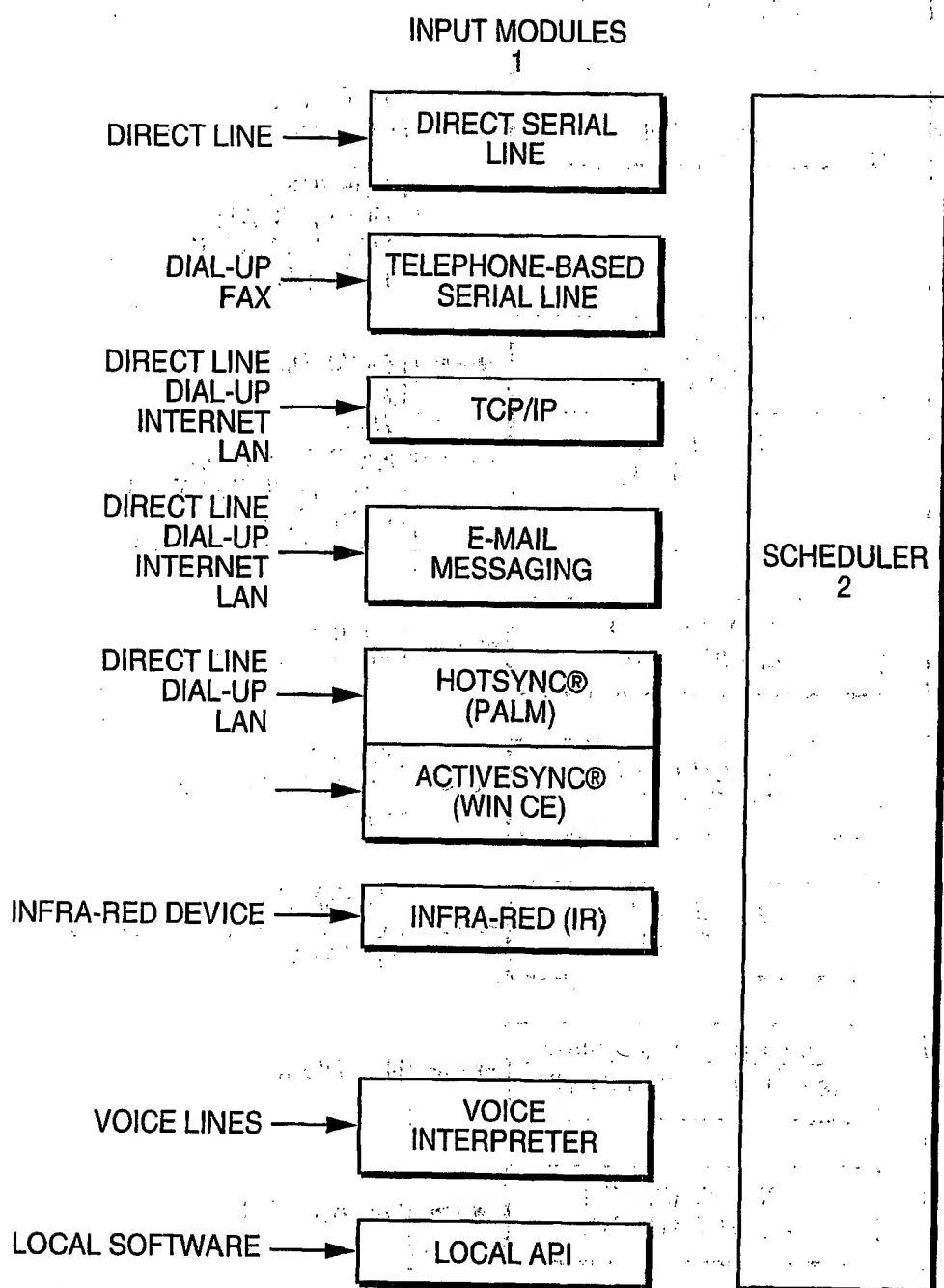
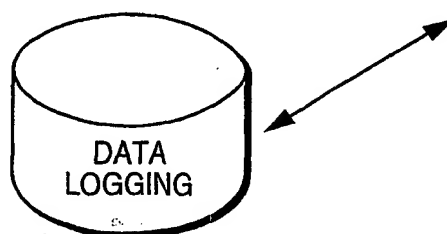
3. U.S. Patent No. 5,982,445 Eyer et al.

U.S. Patent No. 5,982,445 Eyer et al. discloses a control system which displays HTML information on a television. "In accordance with the present invention, an apparatus and method are presented for providing textual and graphical displays using hypertext markup language (HTML) for use with a television decoder." (Eyer, Col. 4, Lines 21 + 24.) The control system disclosed in Eyer is controlled by a user with an input device which can be a remote control, however the disclosed remote control does not include a microprocessor or an integrated visual display. "The user command may be input, for example, by a mouse or other pointing device, a keyboard, or an infrared remote control or the like." (Eyer, Col. 9, lines 3-5.) No additional details of the infrared remote control unit are disclosed.

It is respectfully submitted that the amended claims included on the attached substitute pages involve an inventive step that is not obvious to one skilled in the art in light of the cited references, either alone or in combination.

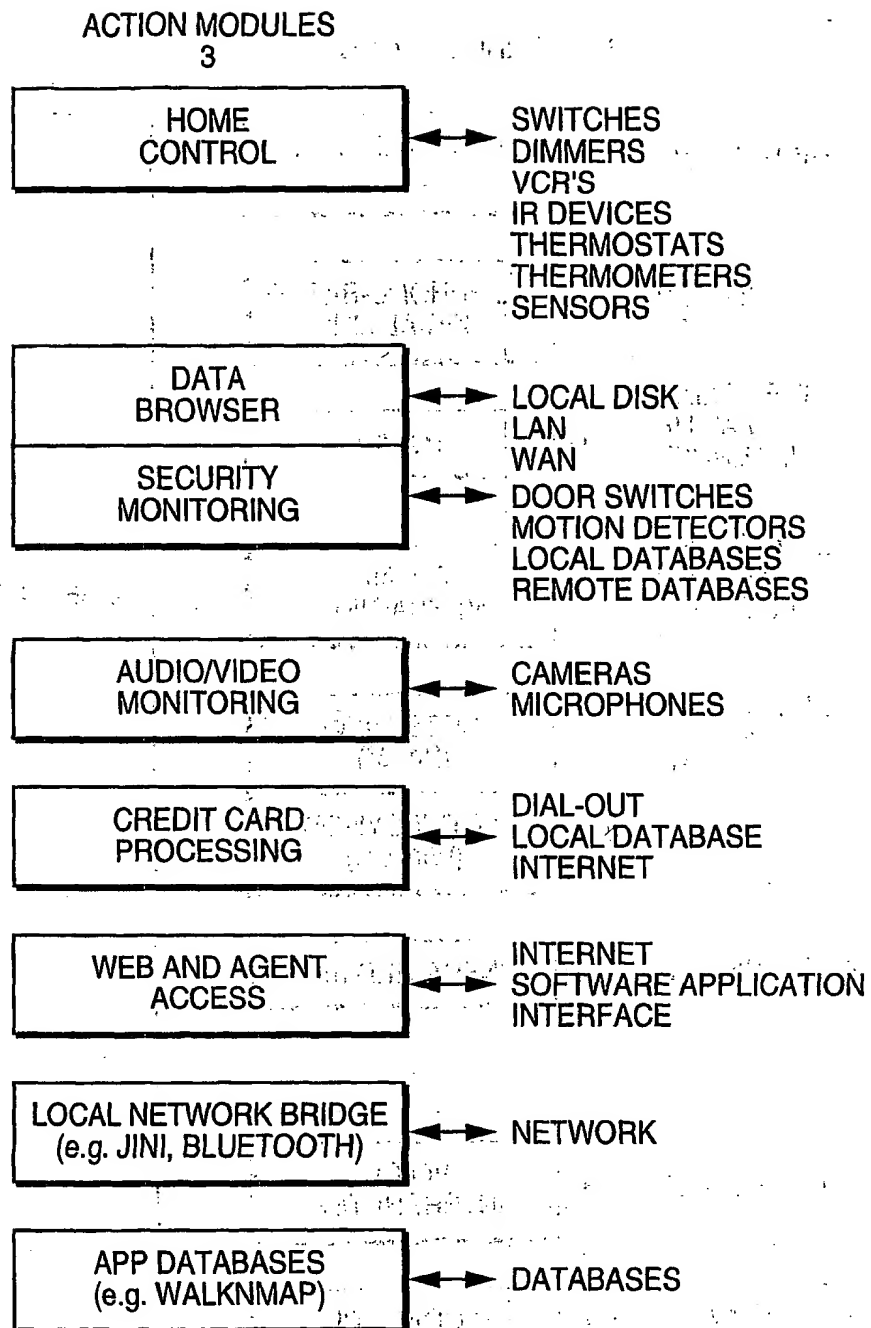
It is further respectfully submitted that the amendments made to the claims do not amend or otherwise impact the description and drawings as originally filed.

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**FIG. 1****FIG. 1A**

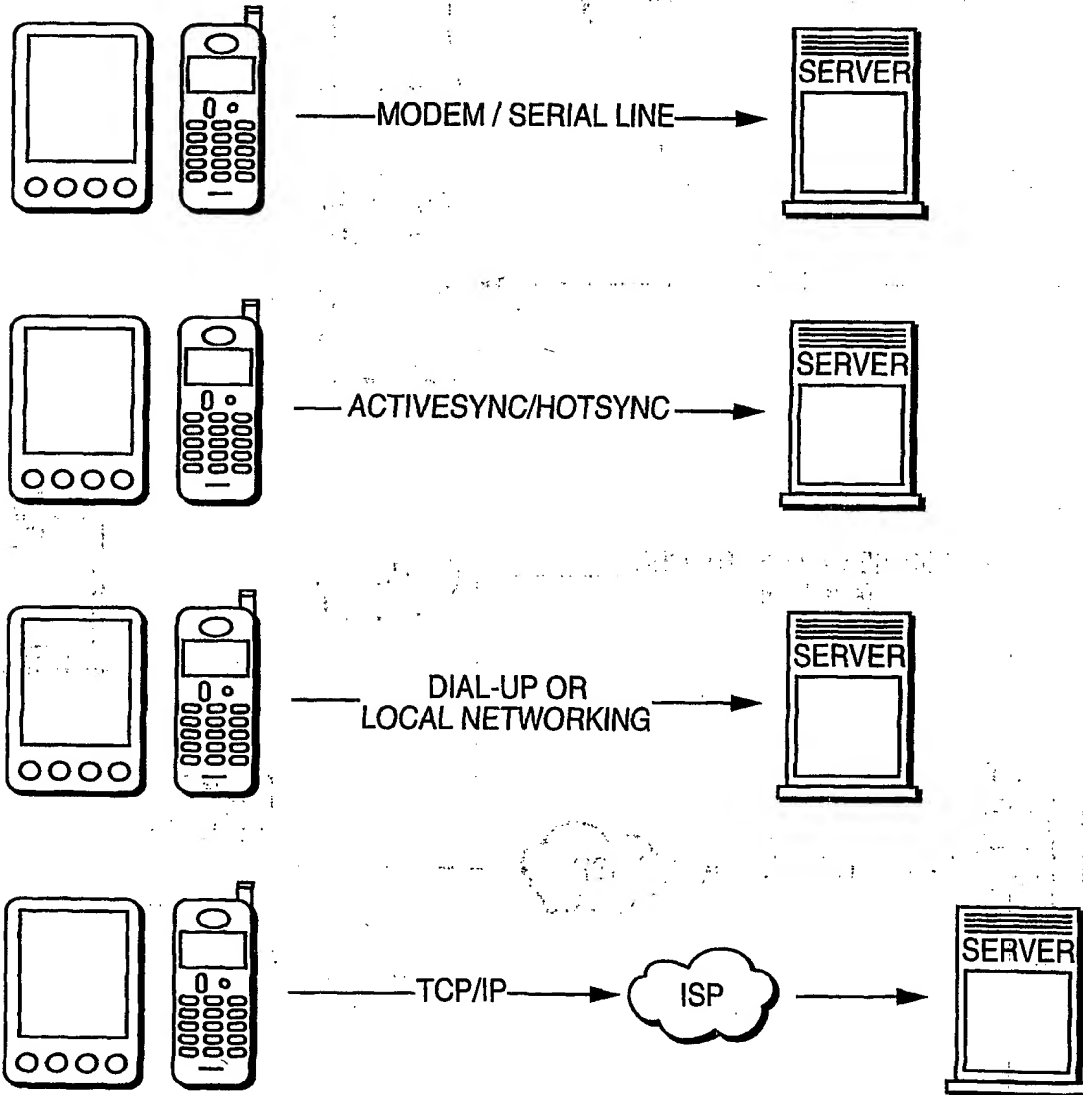
SUBSTITUTE SHEET (RULE 26)

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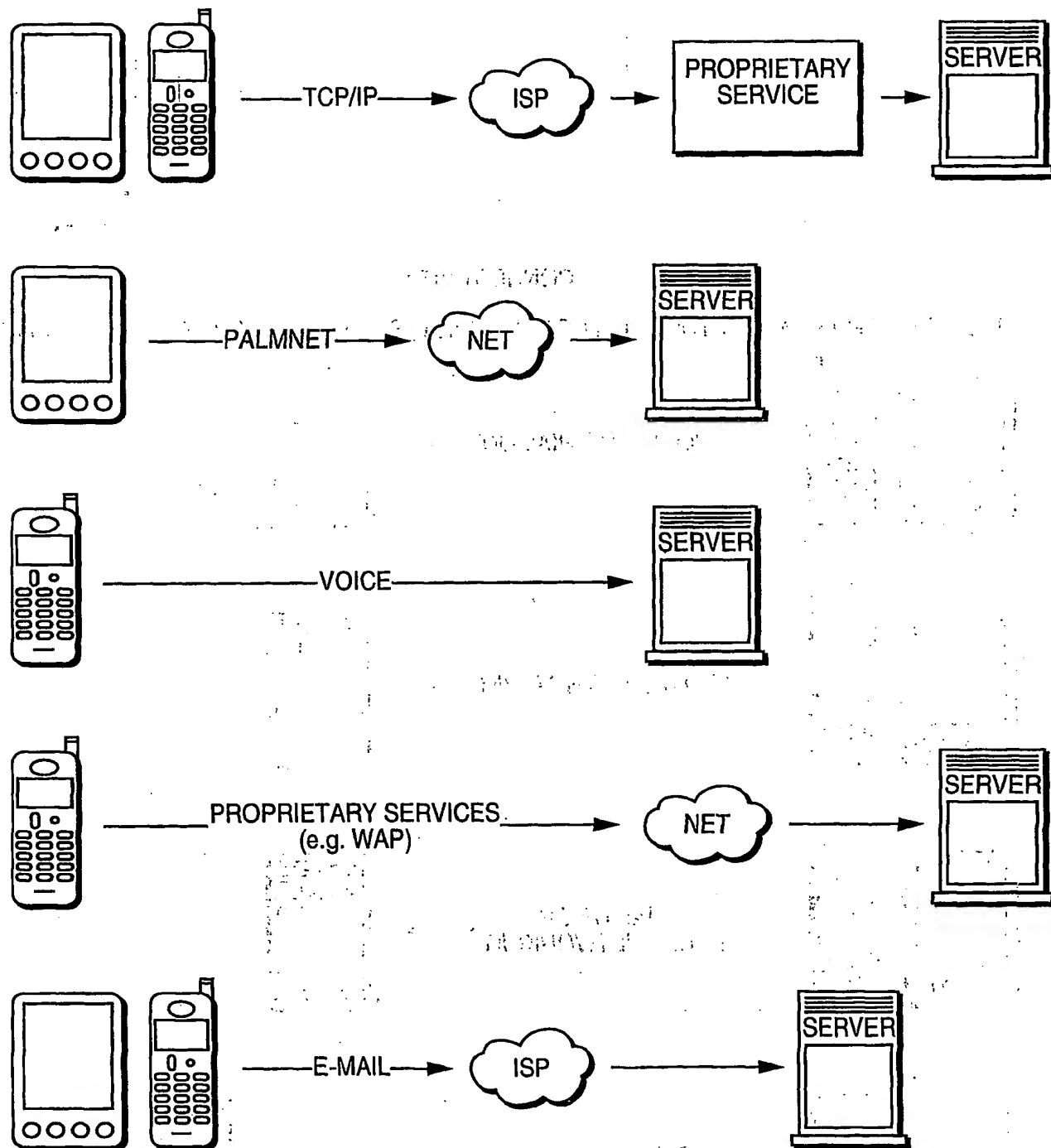
**FIG.
2A****FIG.
2B****FIG.2****CONNECTIVITY**

THERE ARE MANY MODALITIES FOR CONNECTIVITY, SOME OF WHICH ARE LISTED BELOW.

**FIG.2A**

SUBSTITUTE SHEET (RULE 26)

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K10ALL

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
B	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
C	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
D	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
E	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
F	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
G	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
H	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
I	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
J	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
K	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
L	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
M	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
N	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
O	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
P	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

HOME

A	○
B	○
C	○
D	○
E	○
F	○
G	○
H	○
I	○
J	○
K	○
L	○
M	○
N	○
O	○
P	○

DEVICE

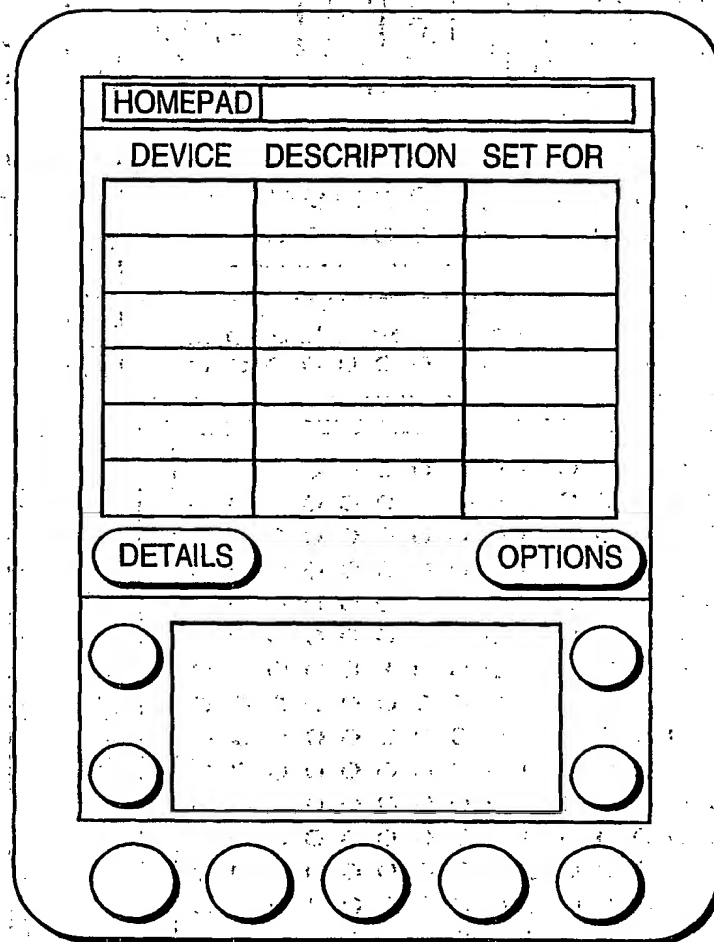
1	○
2	○
3	○
4	○
5	○
6	○
7	○
8	○
9	○
10	○
11	○
12	○
13	○
14	○
15	○
16	○

TOGGLE **ALL OFF** **ALL ON** **HAIL** **SEND** **ACTION** **3**

DIMMER 0% 100% **08** **DIM TO** **15:12:02 08 WAS ON**

ST **STOP** **ON** **OFF** **TOGGLE**

FIG.3

**FIG.4A**

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DEVICE SETTINGS

CURRENT STATE: -----

NEW STATE:

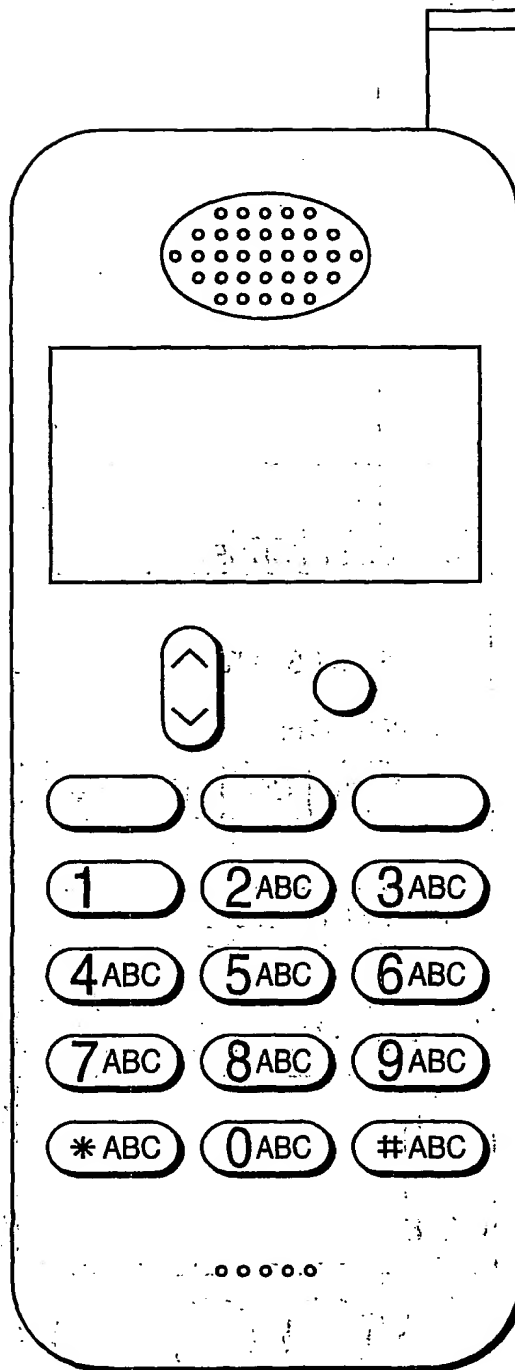
ON OFF NO CHANGE

LAST SET: -----

SAVE CANCEL

FIG. 4B

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CREDIT PAD

ACCOUNT NUMBER

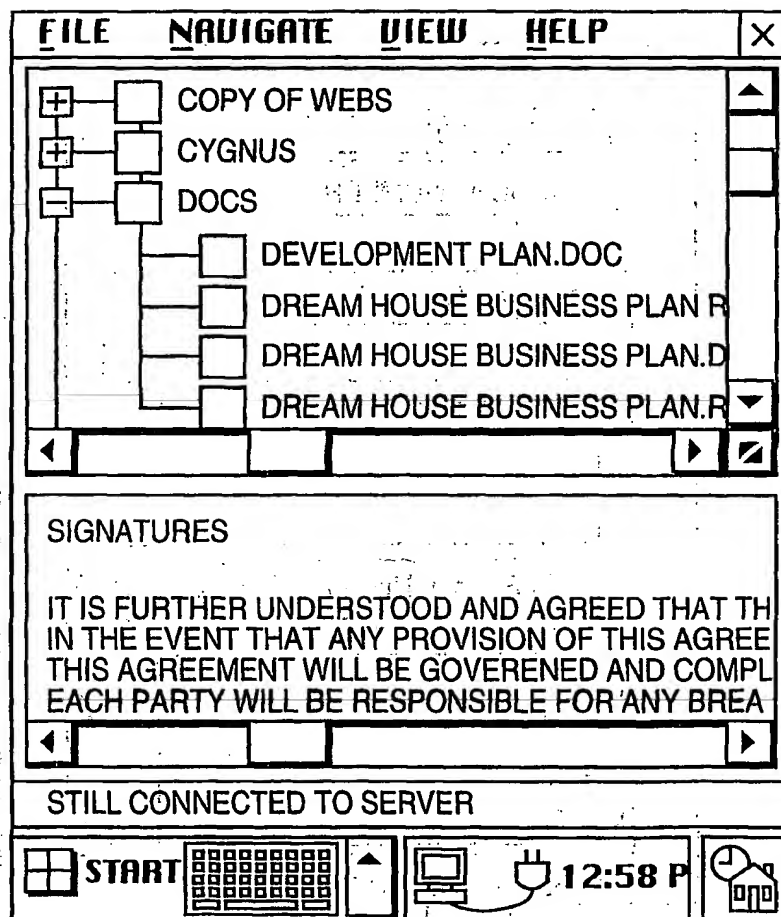
EXP. MM²YY

SAVE HISTORY CLEAR

FIG.6

SUBSTITUTE SHEET (RULE 26)

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**FIG.7**

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 3/00, 13/00, 15/16, 15/177; H04N 5/50

US CL : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/329, 357, 970; 348/460, 461; 370/257; 709/201, 202, 218, 220, 230, 302; 710/8, 9, 10, 104; 712/1, 208; 725/86, 104, 110, 112

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US 6,198,479 B1 (HUMPLEMAN ET AL.) 06 MARCH 2001, COL.2-24	1-46
Y, P	US 6,085,236 A (LEA) 04 JULY 2000, COL.2-29.	1-46
Y, P	US 6,160,796 A (ZOU) 12 DECEMBER 2000, COL.2-26.	1-46
A, P	US 6,038,625 A (OGINO ET AL.) 14 MARCH 2000, COL.2-26.	1-46
A	US 5,982,445 A (EYER ET AL.) 09 NOVEMBER 1999, COL.4-12.	1-46

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	
A document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
E earlier document published on or after the international filing date	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O document referring to an oral disclosure, use, exhibition or other means	*&* document member of the same patent family
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

06 APRIL 2001

Date of mailing of the international search report

07 MAY 2001

 Name and mailing address of the ISA/US
 Commissioner of Patents and Trademarks
 Box PCT
 Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

GLEN BURGESS

Telephone No. (703) 305-4792

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/05073

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

345/329, 357, 970; 348/460, 461; 370/257; 709/201, 202, 218, 220, 230, 302; 710/8, 9, 10, 104; 712/1, 208; 725/86, 104, 110, 112

1. *Chlorophyll a* and *Chlorophyll b* content of the leaves of *C. sinensis* and *C. sinensis* var. *sinensis* were determined by the method of Arar and Johnson (1999).

1. *Chlorophyll a* (Chl *a*)

[illegible]

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1. *Chrysomelids* (Coleoptera: Chrysomelidae) (100%)

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